

# Time Value of Money



“A dollar you receive today is worth more than a dollar you will receive in a year!”



# Time Value of Money

- Face value = The “nominal” value of money
  - What is printed on it
  - The raw amount quoted for a price/product, etc
  - Also known as PRESENT value
- Time value = The “future” value of money when earning interest
  - Similar to “real” value, but has not yet been determined

# Time Value Formula

- $PV = FV / (1 + r)^n$

PV = Present Value

FV = Future Value

r = Interest Rate (expressed as .XX)

n = Number of compounding periods (years)

# Time Value Formula Example

I need \$500 in a savings account in 3 years. I find an account paying 4% interest. How much do I need to put in to make this happen?

- $PV = FV / (1 + r)^n$
- $PV = 500 / (1 + .04)^3 = \$444.50.$
- I need to put \$444.50 in TODAY (present value) to get \$500 in future value.
- NOTE: the interest rate is in the denominator of the formula and, therefore, INVERSELY related to present value!

# So? Who cares?

- Businesses care...A LOT.
- Businesses must make decisions on investments based on future valuations and real return on investments



COURTESY: MCDONALDS

Donald Thompson, CEO McDonalds

# Example from 4-2

- An arcade is going to borrow \$2000 to buy this machine



- They expect the machine to generate future profits of **\$1000** the first year and **\$1,400** the second year and then be completely worthless

# Example from 4-2



- The bank charges the company a nominal interest rate of 9%  
Should the business buy the machine?
- $PV = FV / (1 + r)^n$
- $PV = 1000 / (1.09)^1 + 1400 / (1.09)^2 = \mathbf{\$2,095.78}$
- This means the present value of their future profits (\$2,400) is \$2,095.78. **Ceteris paribus\***, this is a wise investment.
- \*Inflation and opportunity costs will be considered in real life!

# Example from 4-2



- What if the interest rate changes to 15%?
- $PV = FV / (1 + r)^n$
- $PV = 1000 / (1.15)^1 + 1400 / (1.15)^2 = \mathbf{\$1928.17}$
- This means the present value of their future \$2400 is \$1928.17 after they pay their loan with interest. This is **NOT** a wise investment.

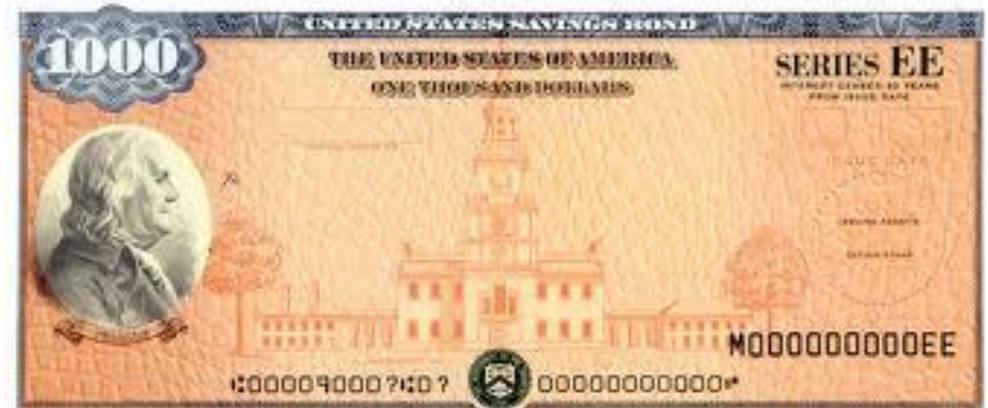
# Bond Market

- Initial treasury bonds issued by US Treasury Department
- Once they are issued, they are bought/sold on the bond market (open market)
- Bond's typically issued for long periods of time
- People may need cash before the bond “matures” creating a need to sell



this guy.

# Buys this \$1,000 bond



- He earns 5% a year on his bond. (\$50 in this case)
- When the bond matures, he gets his \$1,000 back.

Then this happens...



...and he needs cash **now.**

- He should sell his bond right?
- When he goes to sell his bond, however, he learns that \$1,000 bonds are now selling for 7% interest!
- Why would anyone want to buy his bond for 5% interest?



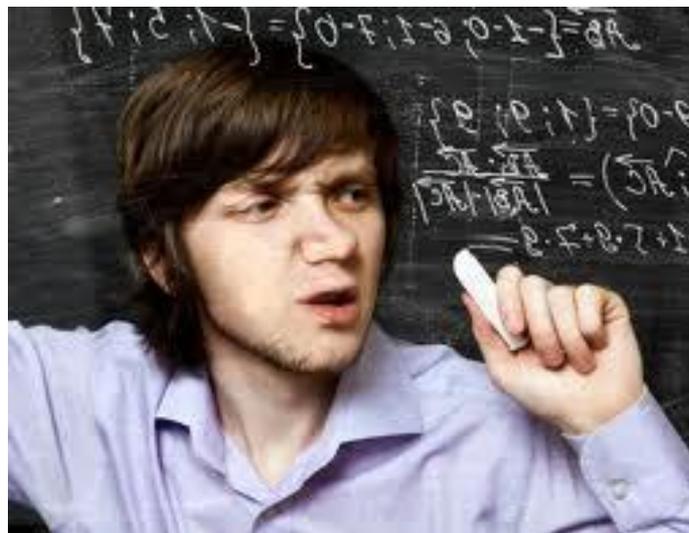
# He tries to complain...



- Batman is right, but by how much?

# Pricing a bond

- Let's assume the guy has 2 years left before the bond reaches maturity.
- That means this year the bond will pay \$50 and next year, the bond will pay \$50 PLUS the original \$1000.
- Now we know the future values, the interest rate (7%) and the time frame – sounds like everything we need for...



# Time Value Formula

- $PV = FV / (1 + r)^n$
- $PV = 50 / (1 + .07)^1 + 1050 / (1 + .07)^2 = \$963.84.$
- **He should put his bond on the market for \$963.84 cents to compete with the current \$1000 bonds.**
- **Why does this work? If someone buys the bond at \$963.84, when they get the \$1,000 that the bond is WORTH, they will have earned 7% return, which is what bonds are paying.**

# Time Value Formula

- Remember, his interest rate is 5%. What happens if bonds are now selling for 3%?
- $PV = FV / (1 + r)^n$
- $PV = 50 / (1 + .03)^1 + 1050 / (1 + .03)^2 = \$1067.96$
- **Someone wanting his 5% interest rate, would need to pay MORE for the bond up front.**

## BIG TAKEAWAYS!!!!

- *Bond prices move **INVERSELY** to interest rates!*
- *Time value of money important to businesses for investment purposes!*
  - *SEE PG 86 of activity 3-1*